Pebble Project
DRAFT - Waterbody Functional Assessment Method Evaluation Matrix
HDR Alaska, Inc.
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	EPA/USFWS 2012 (Harman et al. 2012)	**Alaska Wetland Assessment Method (AKWAM)**	**USACE Savannah District 2004 Standard Operating Procedure**	**Texas Rapid Assessment Method (TX RAM)**	**Ohio EPA QHEI and HHEI; USACE Norfolk District RCI**	**Methods that Require Collection of Site-Specific Data**	**EPA: Rapid Bioassessment Protocol for Use in Streams and Wadeable Rivers**	**BLM Proper Functioning Condition**
Summary of pros/cons	Pros: • Published • Developed by EPA and USFWS • Most recent guidance available • Literature-based • Easy to understand • Can incorporate other baseline info • Useful for evaluating off-site waterbody functions • Objective once GIS reach delineation is established • Precedent exists to add and modify functions Cons: • Only include streams, not other waterbodies • Need to extrapolate results to unsampled streams	Pros: • Published • Developed by COE and ADOT for use in Alaska • Highly Transparent • Includes streams and still waterbodies • Can incorporate other baseline study results • Useful for scoring off-site waterbodies, trans corr, or EIS alternatives Cons: • Not well referenced • Some disturbance factors included in ranking	Pros: • Published • Can incorporate results of documented and site-specific baseline studies • Includes streams and still waterbodies • Transparent • Little adaptation required to make it suitable for Alaska Cons: • Not well referenced • Not applicable to pristine waters; relies heavily on disturbance factors • Evaluation based in terms of impact not in terms of functions. Not a true functional assessment method. Better for use in evaluating credits of mitigation options.	Pros: • Published • Fairly transparent • Literature-based • Generates single overall score which could be useful for mitigation comparison Cons: • Only somewhat applicable to pristine waters; relies heavily on disturbance factors • Only includes streams, not other waterbodies • Would require modification to make it suitable for Alaska • Individual reaches of streams would need to be assessed separately	Pros: • Published • Literature-based • Transparent • Can incorporate other baseline info Cons: • Not applicable to pristine waters; relies heavily on disturbance factors • Only includes streams, not other waterbodies •	Pros: • Published • Generally literature-based • Can incorporate other baseline info Cons: • Only include streams, not other waterbodies • Not applicable to pristine waters; heavy reliance on disturbance factors • Some focus more on adjacent riverine wetlands, rather than the stream	Pros: • Published • Can work for pristine waters • Can incorporate other baseline info Cons: • Does not include lakes or ponds • Low repeatability, partially subjective ratings • Focus too narrow to use for scoring potential mitigation sites	Pros: • Published • Transparent Cons: • Based on BPJ so would not be repeatable • Output too general to characterize impact and mitigation sites • Does not include lakes or ponds • Focuses on the function of riparian-wetlands and not stream functions • Not applicable to pristine waters; all waters would be rated as properly functioning

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Method Description	Most recent stream functional assessment guidance produced by federal agencies (EPA, USFWS). Emphasizes how underlying physically based functions (hydrology, hydraulics, geomorphology) support more physicochemical and biologically based functions (water quality, fish populations). Five functional categories are assessed: Hydrology, Hydraulics, Geomorphology, Physicochemical, Biology. Functional parameters and metrics used to measure the parameters are provided. Numerical values and performance criteria are suggested, but the authors note that they may not be appropriate for all areas of the nation and can be modified based on regional variations in reference condition. Ratings of Functioning, Function at Risk, and Not Functioning are assigned for each category which could also be described as High, Moderate, or Low.	Developed in Alaska, based on Montana DOT Wetland Assessment Method and the method used for defining mitigation debits and credits in Anchorage. Waterbodies are characterized with respect to size and depth; relationship to wetlands; inlets/outlets; channel type; types and levels of disturbance; watershed disturbance; support of resident and anadromous fish, wildlife, and special status species; and potential for recreational and subsistence use. The method then uses fewer characteristics to assign the waterbody to one of four Management Categories that correspond to the categories described by the Corps of Engineers in RGL 09-01. The method could be modified to incorporate more features and more explicitly identify the waterbodies' functions before assigning them to management categories. Many of the waterbody characteristics could be drawn directly from results of other baseline studies as well as wetland and waterbody study.	Allows user to calculate the necessary amount of compensatory mitigation (total mitigation credits required), and in doing so, a section pertaining to the functional assessment of waterbodies is included. This method starts with evaluating adverse impact factors to yield a numeric value for each stream reach impacted. These factors, which serve as the "functions" are: Dominant Effect, Duration of Effects, Existing Condition, Lost Kind, Preventability, Rarity Ranking, Stream Type, and Priority Category. That value is multiplied by total impacted area (for still water) or linear feet of stream in each reach (for streams) to give total mitigation credits required for each area or reach. The second part of the method involves completing worksheets for establishment, restoration/enhancement, preservation, and upland buffer projects, in order to produce the required mitigation credits.	Generates single overall score of wetland or stream integrity and health. Well thought out. Thorough manual. Functions well defined. Fairly transparent. Does not include lakes or ponds. Would take some adaptation for Alaska in some wording of questions (TX veg types, heavy emphasis on non-natives, disturbance types). Some questions would not be applicable to pristine area.	Qualitative Habitat Evaluation Index (QHEI) and Headwater Habitat Evaluation Index (HHEI) measure qualitative habitat corresponding to the physical features that affect fish and invertebrate communities. Index derived from six metrics. Norfolk: Reach Condition Index (RCI) Ohio: Simple data form and scoring system. Thorough definition of metrics. Could be used to compare Alaska streams to other streams worldwide since based on functions that all streams possess, however results designed to be interpreted for warm water habitat. No mention of anadromous fish. Norfolk: No mention of anadromous fish.	1.California Rapid Assessment Method (CRAM) 2.USDA/NRCS Stream Visual Assessment Protocol 3.USACE Headwater Stream Protocol WV and KY Use various metrics grouped to present an overall score. In general the methods are well developed but scores place emphasis on disturbance factors. Some (such as CRAM) are best suited as wetland assessment models.	The Rapid Bioassessment Protocols (RBPs) provide options for agencies and groups that need basic aquatic life data for water quality management purposes. RBPs can serve as a framework for developing a monitoring program and are not intended as rigid protocols without regional modifications. Well developed and concise data sheet. Each parameter has a range of scores within each condition category to allow sensitivity to range of conditions. Not a true functional assessment method, focus is on habitat for aquatic organisms.	BLM approach to determine the health of a riparian-wetland area. The four functional rating categories that a riparian-wetland area could receive using the PFC assessment are *PFC*, *Functional—At Risk*, *Nonfunctional*, and *Unknown*. Based on BPJ, the standard checklist does not provide a direct link or instructions on how the answers should factor into the rating category, but instead leaves the decision of functionality to the "team discussion", which may jeopardize the repeatability of the method. Assessment of PFC focuses on the function of the riparian-wetland area and not the stream.

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Alaska projects on which it has been used, if any	None. EPA Region 10 is using this approach to assess streams in Oregon.	Developed by Corps and AK DOT. Used on a few smaller scale projects (AK RR, DOT Deadhorse Airport Master Plan Update, KGB Road Reconstruction, Nulato Airport Access Road)	None	None	None	None	None	Used as a means of establishing baseline information for streams on BLM lands.
Functions Assessed **Underlined functions are possible ones to add for waterbodies.**	Functional categories assessed: • Hydrology • Hydraulics • Geomorphology • Physicochemical • Biology	Functions not explicitly listed but considers: • T/E species use • Anadromous Fish • Resident Fish (and their human use) • Natural Condition	Functions not explicitly listed. In wetlands and open waters, functions used only in "lost kind categories" and vary by regional method: Riverine forested wetlands/intertidal wetlands, Non-riverine forested wetlands/freshwater areas adjacent to tidal areas, Pine flatwood wetlands, Lakes and impoundments, Naturalized borrow pits <u>We would need to substitute Alaska-appropriate veg types for the above.</u> In-stream functions included only in "Existing condition" factor, so would not need adaptation for undisturbed streams.	• Stream Evolution Process • Energy Management • Riparian Succession • Surface Water Storage • Surface/Subsurface Water Connection • General Hydrodynamic Balance • Sediment Continuity • Substrate & Structure Processes • Sediment Quality and Quantity • Biological Comm. & Processes • Aquatic & Riparian Habitats Trophic Structure & Processes • Water and Soil Quality Chemical Process and Nutrient Cycles • Landscape Pathways	Functions not explicitly listed	CRAM: Landscape context and buffer attributes, hydrology, physical structure, biotic structure USACE: Hydrology, biogeochemical cycling, habitat	Functions not explicitly listed. Habitat, water quality, other biological measures	Dissipating stream energy, reducing erosion, filtering sediment, capturing bedload, aiding floodplain development, improving floodwater retention, improving groundwater recharge, stabilizing stream banks, improving water quality, creating diverse channel characteristics, providing wildlife habitat, supporting biodiversity <u>We would need to add stream-specific functions not related to wetlands.</u>

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Metrics/Indicators/Characteristics	Not all parameters must be measured: Hydrology • Channel forming discharge • Precip/Runoff Relationship • Flood Frequency • Flow Duration Hydraulics • Floodplain Connectivity • Flow Dynamics • Ground/Surface Water Exchange Geomorphology • Sed. Transport Competancy • Sed. Transport Capacity • LWD Transport • Channel Evolution • Bank Migration/Lateral Stability • Riparian Vegetation • Bed Form Diversity • Bed Material Characterization Physicochemical • Water Quality • Nutrients • Organic Carbon Biology • Microbial, Macrophyte, BMI, Fish Communities • Landscape Connectivity	Water flow, Special status species habitat, channel characterization, degree of naturalization/disturbance, degree of salmonid support	Wetlands and open water: Dominant effect, Duration of Effects, Existing Condition, Lost Kind, Preventability, Rarity Ranking Streams: Stream Type Impacted, Priority Area, Existing Condition, Duration of Impacts, Dominant Impact, Scaling factor	• Floodplain Connectivity • Bank Condition • Sediment Deposition • Riparian Buffer • Flow Regime • Substrate Composition • In-stream Habitat • Channel Flow Status	• Substrate • Instream Cover • Channel Morphology • Riparian Zone & Bank Erosion • Pool/Glide and Riffle-Run Quality • Gradient • Channel alteration • Channel condition, Riparian Buffer, In-stream Habitat, Channel Alteration	CRAM: Width, condition, structural patch, topographic complexity, water source, hydro period, hydrologic connectivity, plant layers, native species richness USACE: channel canopy cover, channel substrate embeddedness, channel substrate size, potential channel bank erosion, large woody debris, riparian/buffer zone tree diameter, snag density, sapling/shrub density, species richness, soil detritus, herbaceous cover, watershed land-use,	General land use, stream origin/type, erosion, aquatic vegetation, stream width, stream depth, riparian vegetation features, large woody debris, stream flow, substrate, temperature, conductivity, dissolved oxygen, pH, and turbidity	None, BPJ.

Evaluation Factor	What is this factor and why is it important?	EPA/USFWS 2012 (Harman et al. 2012)	"NWI Plus" (or Watershed-based Preliminary Assessment of Wetland Functions (W-PAWF), including Waterbodies	Alaska Wetland Assessment Method (AKWAM)	USACE Savannah District 2004 Standard Operating Procedure	Texas Rapid Assessment Method (TX RAM)	Ohio EPA QHEI and HHEI; USACE Norfolk District RCI	Methods that Require Collection of Site-Specific Data:	EPA: Rapid Bioassessment Protocol for Use in Streams and Wadeable Rivers	BLM Proper Functioning Condition
1. Adequate data exist (assumes existing fish and hydrology data suffice)?	Collecting additional data would delay the assessment by at least a year. Sufficient information exists for the project area.	Yes. Other teams have collected this data. Some extrapolation would be needed.	Yes	Yes	Possibly. Other teams have collected this data but it would take some extrapolation to use it to answer questions.	Possibly. Other teams have collected this data but it would take some extrapolation to use it to answer questions.	Possibly. Other teams have collected this data but it would take some extrapolation to use it to answer questions.	Possibly. Would require compilation of data for each Assessment Area.	Yes. Other teams have collected this data.	Yes
2. Is a published method?	A method published in a stand-alone document is ideal. A method described and presented in a past Alaska EIS is good. A method used recently is better than one used long ago. A method used successfully without description is OK.	Yes: EPA/USFWS	Yes, except for any modifications and incorporation of project-area info	Yes: as DOT Method	Yes: USACE methods.	Yes: as Texas Method	Yes: As State of Ohio and Norfolk Methods	Yes, all published methods.	Yes	Yes, as BLM method
3. Degree of transparency i.e., is it easy for the reviewer to see how results are derived?	Could an agency reader easily understand how the results were derived? The more steps needed to produce an output, the less understandable (and unquestioned) the results. Also, if the rationale behind the method or individual wetland assessments is not presented, the results are less understandable.	High. All scores are based on metrics that are transparent.	High. Explanation of NWI Plus is clear and familiar to agencies, and GIS models would be intuitive.	High. Transparent crosswalk based on easily discernable indicators displayed in table format.	Medium to high. Some metrics involved but very basic.	Moderate. Metrics are very well defined, but some answers are extrapolated from data or BPJ-based.	High. All scores are based on metrics that are transparent.	High. Answers to questions are often BPJ or based on interpretation of others' data, but model is transparent.	Some metrics involved.	BPJ-focused.
4. Relatively easy to use for scoring potential off-site mitigation projects (mitigation, compensation)?	A method that could be applied to sites away from the project area using the same functions, terminology, and models would ease comparison of impacts to potential compensatory mitigation efforts.	Yes. Functional capacity rankings allow for comparison between impact and mitigation site.	High	High, since directly translatable to Anchorage Debit-Credit Method (ADCM) spreadsheets	Yes. Numerical score for each function for comparison between impact and mitigation site.	Yes. Numerical score for each function for comparison between impact and mitigation site.	Yes. Numerical score for each function for comparison between impact and mitigation site.	Yes. Numerical score for each function for comparison between impact and mitigation site.	Low. Focus too narrow, applies to aquatic organism functions only.	Low. Output is too general to accurately characterize impact and mitigation sites.

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5. Repeatability of method	Primary consideration: How consistent are the results among different users? Secondary: How different would the results be if the models were developed by other scientists, assuming the function is well defined?	High	High? Depends on whether addition of LLWW codes is manual or by GIS model.	High	High	High, but some BPJ required.	High	High, but some BPJ required.	Low. Not BPJ necessarily but picking range of scores for each condition category is subjective.	Low. Heavily focused on BPJ.
6. Can take advantage of information developed by other studies?	Better information that could be used to assess functions has been developed for the mine site than can be estimated by generic models. Use of site information increases the validity of the assessment.	Yes, with some interpretation. Data must be extrapolated to unsampled reaches but this approach allows for the maximum use of baseline data.	Yes, mainly fish data.	Yes, mainly fish data.	Yes, with some interpretation in applying results to questions asked on data form. Data must be extrapolated to unsampled reaches.	Yes, but some questions based on judgment. Data must be extrapolated to unsampled reaches.	Yes, with some interpretation in applying results to questions asked on data form. Data must be extrapolated to unsampled reaches.	Yes, with some interpretation in applying results to questions asked on data form. Some BPJ required. Data must be extrapolated to unsampled reaches.	Yes, with some interpretation in applying results to questions asked on data form. Data must be extrapolated to unsampled reaches.	Yes, to inform BPJ.
7. Literature-basis is presented (thus more defensible)?	Some published methods explain little of the literature basis of the method. Using a method with documented science-based rationales would be better. (It is typically lacking.)	Yes, extensive references.	Yes, but less so for streams.	No	No	Yes	Yes, extensive references.	Yes	Very lightly referenced to literature.	Yes. Developed by university.

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8. Method works for pristine waters (that is, does not compare against fully functional waters)?	Most methods evaluate some wetland functions in the context of surrounding human development -- how they protect human developments and moderate effects of development. They may assume wetlands are human-disturbed. These factors don't apply in the Pebble Project area.	Yes.	Yes for some functions; others require re-definition and modifications of models.	Not that well. All would be Category 1 or 2, depending on SSS habitat. 3 categories give not much room for ranking.	No. Function ratings rely heavily on disturbance factors for streams.	Somewhat. Yes for some functions; others require re-definition and modifications of models, since several questions compare stream functions with degradation by human use, disturbance, etc.	No. Ratings rely heavily on disturbance factors.	Only somewhat. A lot of questions are targeted towards disturbed areas.	Yes	No. All would be ranked as being in properly functioning condition.
9. Individual polygons or assessment areas would NOT need to be manually coded	Coding of individual polygons would be extremely time consuming and would insert a subjective step into the analysis, Individuals would not code consistently, nor would coding be consistent among coders.	Streams are broken down into specific reaches to be assessed separately; however streams could be classified and correlations between stream type and functions could be drawn.	True but some coding will still be needed.	True. Variables could be incorporated into GIS based model.	Streams are broken down into specific reaches to be assessed separately; however streams could be classified and correlations between stream type and functions could be drawn.	Streams are broken down into specific reaches to be assessed separately; however streams could be classified and correlations between stream type and functions could be drawn.	Manual coding for stream reaches necessary. Streams are broken down into specific reaches to be assessed separately; however streams could be classified and correlations between stream type and functions could be drawn.	Streams are broken down into specific reaches to be assessed separately; however streams could be classified and correlations between stream type and functions could be drawn.	Some modeling may be possible but manual coding for stream reaches necessary.	False

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10. Delineation of assessment area is more objective than subjective	Any method that evaluates functions will require analysts to delineate the boundaries of each assessment area. Consistent delineation of assessment areas would yield repeatable results among different analysts.	Yes. Streams are evaluated at the reach level.	To some degree.	Yes	Yes	Yes. Streams must be evaluated within Stream Assessment Reaches (SAR), but manual gives clear guidelines on how to do that.	Yes. Headwaters to be rated separately from other stream reaches.	No	No	No